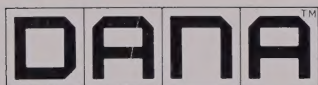


REVISED CALIBRATION PROCEDURE
FOR THE
MODEL 4400 SERIES
DVM



Dana Laboratories Incorporated
Irvine, California 92664

Telephone (714) 833-1234
Teletype 910-595-1136



REVISED CALIBRATION PROCEDURE
FOR THE
MODEL 4400 SERIES
DVM

October, 1968

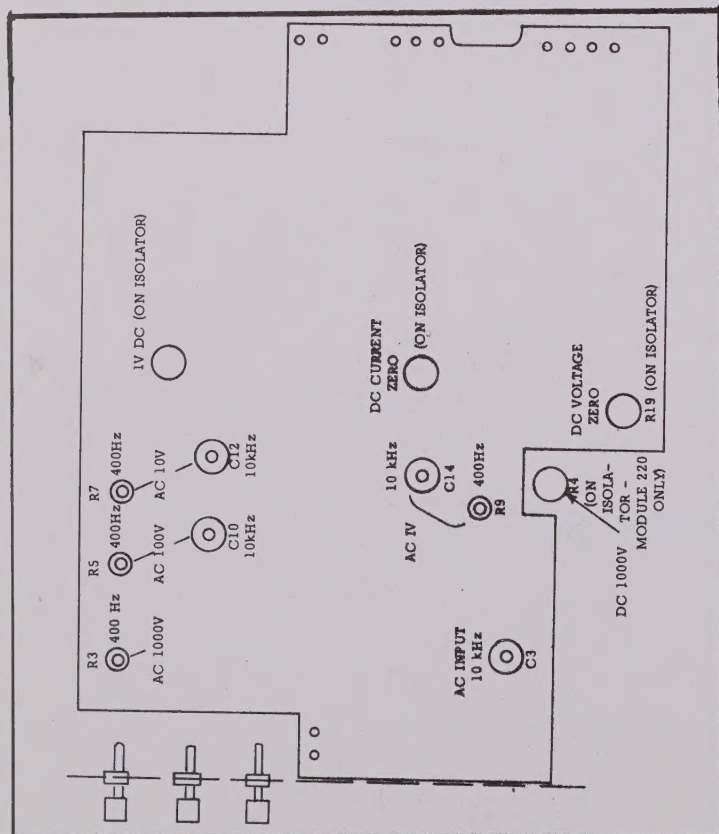


Figure 1. Locations - AC Converter (Bottom View)

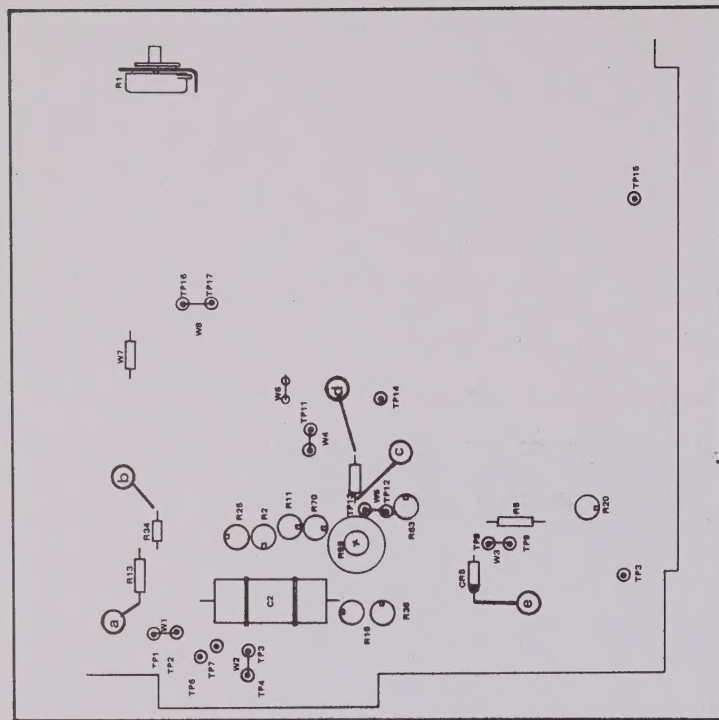


Figure 2. Locations, Digitizing & Display

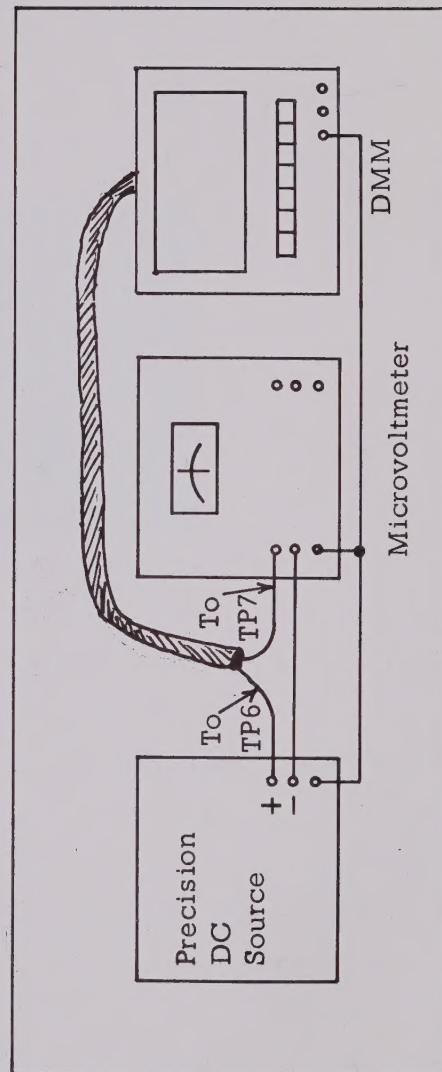


Figure 3. Test Setup - Reference Voltage

CALIBRATION

1. INTRODUCTION

2. General. This calibration procedure eliminates the necessity of unsoldering and resoldering jumpers on the readout board of the 4400 series DMM. Any necessary maintenance should be done prior to calibration. Each calibration step in this procedure relies on the accuracy of the preceding step. Care should be taken to make each adjustment in the order that appears in this procedure.

3. EQUIPMENT

4. General. The following equipment is required for DMM calibration, and is listed in order of use. The specifications listed are the minimum required to make the adjustment, not the accuracy of the instrument mentioned. Equipment required for the calibration of the Digitizing and Display portion and the DC portion of the accessory module are listed below.

- (a) Precision null detector/microvoltmeter with a minimum of 10 microvolts of resolution. For example, Fluke Model 845AR.
- (b) Voltage calibrator variable from 0 to 1000 volts and a resolution better than 100 microvolts (at 1 and 10 volts). For example, Fluke Model 332A.

5. Model 220 Accessory Calibration. Equipment required for the calibration of the AC portion of the Model 220 Accessory Module is listed below.

- (a) Laboratory power source (AC) variable from 0 to 500 volts and 50 to 100 kHz with a resolution better than 100 microvolts (at 1 and 10 volts). For example, Optimization AC 104.

- (b) AC/DC laboratory transfer standard for calibration of the AC source. For example, Holt Model 6 Thermal Transfer Voltmeter.

6. TOOLS

- (a) Insulated blade-type calibration tool.

- (b) No. 1 Phillips screwdriver.

7. OTHER

- (a) 100,000 ohm 1/4 watt, 5% carbon resistor.

- (b) 51,000 ohm 1/4 watt, 5% carbon resistor.

- (c) 2 megohm 1/4 watt, 5% carbon resistor.

8. This section combines the calibration adjustments for the Digitizing and Display portion with the Accessory portion. If desired, one portion, the Accessory Module for example, can be calibrated separately, provided that the other portion is known to be calibrated. Each calibration adjust heading is clearly marked whether for Digitizing and Display, Accessory, or Accessory Module 220.

9. PREPARATION

- (a) Remove both the top and bottom covers of the DMM. Set the Model 4400 OFF-ON-HOLD switch to ON and allow at least 30 minutes for the instrument to warm up.

10. ADJUST RAMP GENERATOR ZEROS (Display Module)

- (a) Remove Isolator Module

- (b) Connect a jumper between TP4 (Ramp Input) and TP6 (Reference Common).

- (c) Connect a 10K ohm resistor across capacitor C2.
- (d) Connect a jumper from the junction of R13 and the base of Q3 (point a on figure 2.) to TP6.
- (e) Connect the positive side of the precision calibrator source in series with a 2 megohm resistor to the junction of R33 and R34 (point b). Connect the low side of the source to TP6.
- (f) Connect the positive input of the microvoltmeter in series with a 51K ohm isolation resistor to the same junction of R33 and R34. Connect the low side to TP6.
- (g) Adjust the calibrator voltage for a reading of zero $\pm$ 30 microvolts.
- (h) Connect the positive input of the microvoltmeter in series with the 51K ohm isolation resistor to the top of C2 (figure 2.). Retain the low side at TP6.
- (i) Adjust the voltage zero R25 for a reading of zero $\pm$ 30 microvolts.
- (j) Move the microvoltmeter positive input to TP11.
- (k) Adjust the current zero R11 for a reading of zero $\pm$ 30 microvolts.
- (l) Verify results of steps f, h and j to establish optimum zeros.
- (m) Do not remove jumpers or voltages until after paragraph 11.

11. ADJUST NULL DETECTOR ZERO (Display Module)

- (a) Connect a jumper between TP1 and TP6.
- (b) Attach another jumper from the junction of R56 and R57 (point c) to TP6.

- (c) With the low side of the microvoltmeter still attached to TP6, connect the positive input to the summing node junction of R57, R58 and R59 (point d).
- (d) Adjust the current zero, R63, to read zero $\pm$ 30 microvolts.
- (e) Remove the jumper from the junction of R56 and R57 to TP6.
- (f) Remove all other jumpers, resistors and voltages.
- (g) Reinstall Isolator Module.

12. ADJUST INTERNAL REFERENCE (Display Module)

- (a) Set the Voltage Calibrator to the reference voltage value recorded on the zener serial tag mounted on the back of the display shield.
- (b) As shown in figure 3, connect the positive side of the voltage source to the cathode side of CR5 (point e) and the positive input of the microvoltmeter to TP7. CAUTION: Avoid shorting cathode of CR5 to adjacent straps.
- (c) Connect the negative side of the calibrator to the low side of the microvoltmeter and tie their case connections together.
- (d) Adjust the zener calibration potentiometer R36 for a microvoltmeter reading of zero $\pm$ 10 microvolts.
- (e) Remove the leads to CR5 and TP7.

13. ADJUST DC ISOLATOR ZEROS

- (a) Allow adequate warm-up time if isolator plug-in has just been re-installed into DMM.

- (b) On the display board, connect the microvoltmeter input lead to TP2 and the low side to the input common terminal of the accessory module (white). Connect a jumper between the + input (red) and input common (white) terminals of the accessory module. (Be sure the DMM is in DC and in the 10 volt range.)
- (c) Remove the power to the DMM and adjust the front-panel zero control R22 to its mechanical center. Open the accessory drawer. Connect a jumper across R5 (100K, 1% resistor) and replace the accessory drawer.
- (d) Apply power and adjust the voltage zero control R19 for a microvoltmeter reading of zero $\pm$ 100 microvolts.
- (e) Select the 1000 volt range.
- (f) Adjust the current zero control R31 for a microvoltmeter reading of zero $\pm$ 100 microvolts.
- (g) Remove power from the DMM and open the accessory drawer. Remove the microvoltmeter leads and the jumper across R5. Replace the accessory drawer and reapply power. Remove jumper from across DMM input.

14. ADJUST DMM POLARITY (Display Module)

- (a) Select the 10 volt range. Connect the DMM input terminals to a DC voltage source and set the voltage source output to -.002 volts.
- (b) Adjust the null detector voltage zero control R70 for a display reading bouncing between -0.001 and -0.002 volts.
- (c) Set input to +0.002 volts. Adjust R20 (voltage zero control for the auto polarity) for a display reading bouncing between 0.001 and 0.002 volts.

15. ADJUST POSITIVE AND NEGATIVE GAIN (Display Module)

- (a) Set the calibrate control R1 on the front panel to its mechanical center.

- (b) Set the voltage source output to -9.9990 volts.
- (c) Adjust the rough calibration control R2 for a DMM display reading of 9.9 volts. Adjust R1 for a display reading bouncing between -9.998 and -9.999.
- (d) Reverse the polarity of the voltage source (+9.9990).
- (e) Adjust the positive polarity gain control R55 for a display reading bouncing between 9.998 and 9.999 volts.
- (f) Repeat steps a through d for interaction between controls.

16. ADJUST VOLTAGE DIVIDER (Accessory Module)

- (a) Set the voltage source output to -1.0000 volts and range to 1.
- (b) Adjust isolator gain control R53 for a display reading of -1.0000.
- (c) Select a DMM range of 1000.
- (d) Set the voltage source to -10000.0 volts.
- (e) Adjust voltage divider control R4 (R3 on 220) for a DMM display reading of -1000.0
- (f) Set the voltage source to -1 volt and remove the supply from the input terminals.

17. ADJUST CALIBRATE TEST (Display Module)

- (a) Select a DMM range of 1.
- (b) Manually depress and hold in the calibration switch

(c) Adjust R15 for a display reading of -1.0000.

18. ADJUST AC VOLTAGE DIVIDER (Accessory Module 220)

- (a) Connect DMM input terminals to the AC voltage source.
- (b) Select AC function and autorange.
- (c) Set AC source output to 125.00 volts at 400 Hz.
- (d) Adjust the 1000 volt , 400 Hz control for a DMM display reading of 0125.0 volts.
- (e) Set AC source to 125.00 volts at 10 kHz.
- (f) Adjust the AC input, 10 kHz control for a DMM display reading of 125.0.
- (g) Set the AC source to the following series of AC voltages and adjust the appropriate controls as called out on the bottom plate of the Accessory Module. (See figure 1.).

<u>VOLTS RMS</u>	<u>FREQUENCY</u>
0.90000	400 Hz
0.90000	10 kHz
9.0000	400 Hz
9.0000	10 kHz
90.000	400 Hz
90.000	10 kHz

DANATM

MP MASTER



MA31135